Syllabus

Course Title: CSCE 274 Robotics Applications and Design

Instructors: Ioannis Rekleitis,
Storey Innovation Center
Computer Science and Engineering
Room 2235
550 Assembly Street, Columbia, SC
Email: yiannisr@cse.sc.edu

Ibrahim Salman,
Storey Innovation Center
Computer Science and Engineering
Room 2101
550 Assembly Street, Columbia, SC
Email: ijsalman@email.sc.edu

Class meeting:

Aug 19 – Dec. 02	Section 1: TTh 16:25– 17:40 p.m.
	Section 2: TTh 14:50– 16:05 p.m.
Location:	Section 1: Swearingen Engr Ctr Room: 2A15
	Section 2: 300 Main St. Room: B102

Final Exam standard time.

Credits: 3

Course Description: Robotics has seen a widespread development in recent years, due to its possible applications (e.g., house cleaning, surveillance). There are several challenges that designers face during the development of systems of autonomous mobile robots, from low level issues -- i.e., sensors, actuators, etc. -- to high level issues -- i.e., control, navigation, etc.

This course aims at introducing to robotics from a computing perspective. After an overview of different types of robots, sensors, and locomotion, algorithms for robotic perception, planning, navigation, localization, and manipulation are presented. The students will have the chance to implement some of the concepts seen in the class on a mobile robot (Duckiebot). The instructor would draw from his experiences in robotic research to enrich the material with aspects of active research problems, such as: multi-robot exploration for search and rescue; environmental coral reef monitoring using underwater robots; etc.

Course learning outcomes:

After completing this course, you should be able to:

- Describe the components of modern robot systems.
- Apply robotic control architectures
- Implement autonomous navigation and planning on mobile robot platforms.

Prerequisites:
CSCE 146 (Algorithmic Design II)
In general, good programming skills.

Required text(s):
There is one required textbook:
Maja J. Mataric, The Robotics Primer. MIT Press, 2007.
Reading assignments throughout the semester will require access to this book. Fortunately, the textbook is ~$20 ($23.75 on Amazon), which is relatively inexpensive for a text.
Additional material will be based on online resources.

Schedule, deliverables, and evaluation:
Your learning in this course will be evaluated based on:

- Homework assignments throughout the semester. You should use the CSE Moodle server (https://dropbox.cse.sc.edu) to submit your solutions. These assignments will account for 30% of your final grade.
- Robot programming assignments using the Duckiebot platform. These assignments will be completed also individually. Programming assignments will account for 40% of your final grade.
- One in-class tests, accounting for 10% of your final grade.
- A final exam, covering the entire course, but with greater emphasis on the final third of the course. The final will account for 20% of your final grade.

Type	**Number**	**Percent**
Homework assignments	10	3%
Robot programming assignments	4	10%
In class tests	1	10%
Final Exam	1	20%
Total		**100%**

Late Submission Policy:

- **Homework assignments:** ***No late submissions***
- **Robot programming assignments: -10% per day for the first 3 days. Then no submission.**
-

Schedule:

1. Introduction
2. History
3. Robot Components
4. Intro to h/w -- DuckieBot
5. Overview of Python
6. Overview of Linux
7. Overview of Docker
8. ROS Programming

9. Robot motion -- Control
10. Sensing -- Computer Vision
11. Sensing -- Duckie Vision
12. Lab sessions
13. Navigation Locomotion
14. Architectures/Research
15. Learning in Robotics
16. Deep Learning
17. Ethics
18. State Estimation
19. Robots of the World

Teaching style
The class will be meeting in person Tue/Thu. It will be very important for you to follow each lecture in a timely manner. There will be a hardware component, a robot kit, which will be distributed in class. If you are not present, it is your responsibility to arrange for pickup. Homework, assignments and exams will be returned within one week. If there are any delays, there will be an announcement. The instructors and TA will try to answer emails in 24h, or my sending a message to everyone through the dropbox.cse.sc.edu system, or in class.

- Student-to-Instructor (S2I) Interaction: Students will attend/listen/view lectures in person and interact with the professor in class through email. The professor will post regular announcements, provide individual feedback to students, and hold office hours at the lab. In addition the instructor will send messages through the CSE Moodle server (https://dropbox.cse.sc.edu).
- Students-to-Student (S2S) Interaction: Students will engage in discussions through email, in person, and in the lab.
- Student-to-Content (S2C) Interaction: Students will engage with course content by completing assignments and participating in lab sessions, and face to face lectures.

Grading Scheme:
>=90% : A
>=87% : B+
>=80% : B
>=77% : C+
>=70% : C
>=60% : D
<60% : F

Course Policies:
- Wearing face covering properly is the standard university policy:
  "**Face coverings will be required at all times inside all campus buildings, unless you are in your own residence hall room, private office or you**

are eating inside campus dining facilities. They are also required on shuttles, buses and other forms of university transportation."
See: https://sc.edu/safety/coronavirus/safety_guidelines/index.php

- Late assignments: Homework assignments will not be accepted late, because the answers will be discussed in class immediately. Unless the course schedule prevents it, programming assignments will be accepted up to three days late, subject to a 10% penalty for each day or fraction of a day.
- Computing platform: You will be expected to write software to control real robots. These tasks are most straightforward in the Python language, and the course will provide some direct instruction on how to do so. You are also welcome to identify and use other appropriate languages if you prefer, provided that using such a language does not trivialize the assignment. However, we will not provide assistance with this.
- The hardware used this year will require the use of a Linux based computer. The course will provide a brief introduction to the relevant technology.
- Policy changes: Changes to the syllabus at the instructor's reasonable discretion, including changes to the evaluation and grading mechanisms, are possible but unlikely.

Technologies used in this class:

- Linux operating system
- ROS
- Docker
- Python
- OpenCV

Academic Integrity:
You are expected to practice the highest possible standards of academic integrity. Any deviation from this expectation will result in a minimum academic penalty of your failing the assignment, and will result in additional disciplinary measures. This includes improper citation of sources, using another student's work, and any other form of academic misrepresentation.

University policies and procedures regarding academic integrity are defined in policy STAF 6.25, Academic Responsibility - The Honor Code (see http://www.sc.edu/policies/ppm/staf625.pdf). Prohibited behaviors include plagiarism, cheating, falsification, and complicity. All potential Honor Code violations will be reported to the Office of Student Conduct and Academic Integrity, which has the authority to implement non-academic penalties as described in STAF 6.25. Academic penalties for Honor Code violations in this course range from a zero on the assignment to failure of the course.

Use of online resources that contain the solution to a homework/assignment/exam is strictly prohibited and will result to failure of the course.

Attendance Policy:
When you miss class, you miss important information. In these days of COVID 19, that means either physical or virtual. If you are absent, you are responsible for learning material covered in class. If you are absent when an assignment is due, you must have submitted the assignment prior to the due date to receive credit. It is your responsibility to follow along.

Accommodating Disability:
Reasonable accommodations are available for students with a documented disability. If you have a disability and may need accommodations to fully participate in this class, contact the Office of Student Disability Services: 777-6142, TDD 777-6744, email sasds@mailbox.sc.edu, or stop by LeConte College Room 112A. All accommodations must be approved through the Office of Student Disability Services.

Diversity:
In order to learn, we must be open to the views of people different that ourselves. In this time we share together over the semester, please honor the uniqueness of your fellow classmates and appreciate the opportunity we have to learn from one another. Please respect each others' opinions and refrain from personal attacks or demeaning comments of any kind. Finally, remember to keep confidential all issues of a personal or professional nature that are discussed in class.